Editorial
Glyphosate-Resistant Weeds and Crops

Throughout the past 50 years, the quantity and quality of world food production has risen dramatically in many (but not all) countries, sustaining the world's population despite the fact that this population has more than doubled over this period. The introduction of modern agricultural chemicals has greatly contributed to abundant world food production by controlling crop pests such as yield-diminishing weed infestations. No chemical has had a greater positive impact than the herbicide glyphosate. Developed by the Monsanto Company and introduced to world agriculture in 1974, glyphosate has become the world's most important herbicide.

Glyphosate controls a wide spectrum of weed species in a cost-effective and environmentally benign manner and is relied upon in systems ranging from broad-area agriculture to urban landscapes. Until 1996, glyphosate could not be easily used within arable crops, as crop species also succumb to glyphosate. However, with the development of transgenic glyphosate-resistant crops, glyphosate can now be used to remove infesting weed species without crop damage. This innovation has many benefits, both economic and environmental, and consequently has had a spectacularly widespread adoption, particularly in the major food-producing countries of Argentina, Brazil, Canada and the USA. Now, transgenic, glyphosate-resistant soybean, maize, canola and cotton dominate in these countries, with the glyphosate-resistant crops grown in just these four countries making up over 80% of the 100 million hectares of transgenic crops grown in the world. Transgenic, glyphosate-resistant crops are now being introduced elsewhere in the world.

The advent of transgenic, glyphosate-resistant crops has further dramatically increased the already very widespread usage of glyphosate. Glyphosate is easily the world's most important herbicide and most heavily used pesticide. With glyphosate-resistant crops, it is possible to rely almost solely on glyphosate for weed control, with a concomitant reduction in the usage of other herbicides and non-chemical weed control tools. Thus, in the USA, Argentina and Brazil, glyphosate has largely replaced other herbicides previously used for weed control in these crops. Furthermore, in these crops, tillage has been significantly reduced. Therefore, there has been a loss of diversity in weed control tools used, with maximum reliance being placed on glyphosate. While there are many benefits associated with transgenic, glyphosate-resistant crops, the persistent reliance on glyphosate without diversity increases the risk of weed species evolving resistance to glyphosate and it is now evident that this is occurring in several prominent weed species, especially in transgenic, glyphosate-resistant cropping agro-ecosystems. This evolution of glyphosate-resistant weed populations threatens the ongoing sustainability of glyphosate and its contribution to world food production.

As we believe that the evolution of glyphosate resistant weeds threatens world food production, we organized an international symposium at the 233rd American Chemical Society meeting held in March, 2007 in Chicago, Illinois (USA) to bring together global experts to consider glyphosate sustainability for world cropping. This special issue of *Pest Management Science* contains papers arising from this symposium.

This issue contains an introductory paper[1], followed by three papers on glyphosate-resistant crops.[2–4] Next, there is a paper on the economics of glyphosate-resistant crops.[5] The paper by Feng *et al*.[6] then describes the activity of glyphosate as a fungicide on glyphosate-resistant crops. This is followed by five papers on aspects of herbicide resistance of weeds, including evolved resistance in different parts of the world,[7,8] the role of altered glyphosate translocation in evolved glyphosate resistance,[9] weed species shifts in glyphosate-resistant crops,[10] and farmer perceptions of glyphosate-resistant weeds.[11] Three papers discuss how the evolution of glyphosate resistance can be modeled and predicted[12–14] and two more deal with managing glyphosate weed resistance.[15,16] A final group of papers deals with environmental aspects of glyphosate and glyphosate-resistant crops, including papers on gene flow from these crops,[17] glyphosate behavior in soil,[18] the influence of conservation management methods used with glyphosate-resistant crops on the environment,[19] changes in environmental risks in the US[20] and Europe[21] that have or could occur with the adoption of glyphosate-resistant crops, and the effect of low doses of glyphosate on non-target plant life.[22]

We are convinced that the unique features of glyphosate vitally necessitate its preservation for future harvests. Allowing glyphosate-resistant weeds to evolve unchecked will have huge adverse effects on the future of weed management worldwide. We hope that actions can be galvanized to save the world's greatest herbicide for future generations and future harvests.

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DOI: 10.1002/ps.1561

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DOI: 10.1002/ps